

A NEW *CALCINUS* (DECAPODA: ANOMURA: DIOGENIDAE)  
FROM THE TROPICAL WESTERN ATLANTIC, AND A  
COMPARISON WITH OTHER SPECIES OF THE  
GENUS FROM THE REGION

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*Abstract.*—A new species of a diogenid hermit crab, *Calcinus urabaensis*, is described from the Gulf of Urabá, on the Caribbean coast of Colombia. The new species is the third in the genus described from the western Atlantic, and can be distinguished from the other two known species of the genus *Calcinus* in the region, *C. tibicen* (Herbst) and *C. verrilli* (Rathbun), by differences in coloration and armature of the dactyl of the left cheliped, third pereopod, and telson. A comparison of the three species is included.

*Resúmen.*—Se describe una nueva especie de cangrejo ermitaño perteneciente a la familia Diogenidae, *Calcinus urabaensis*, colectada en el Golfo de Urabá, Caribe sur. La nueva especie es la tercera conocida de este género en el Atlántico occidental, y se diferencia de las otras dos especies del género *Calcinus* de la región, *C. tibicen* (Herbst) y *C. verrilli* (Rathbun), en la coloración y espinas del dactilo de la quela izquierda, tercer pereópodo, y telson. Se presenta una comparación de las tres especies.

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Compared to other tropical regions of the world oceans, the western Atlantic contains very few species of the diogenid genus *Calcinus* Dana, 1852. Recent studies of *Calcinus* species in the Pacific, for example, have shown that nine species occur on the Hawaiian Islands (Haig & McLaughlin 1984), 11 species on the Mariana Islands (Wooster 1984), and 17 species on the Australian coast (Morgan 1991). In contrast, only two species have been described from the western Atlantic, *C. tibicen* (Herbst, 1791), broadly distributed from Florida to Brazil, including Bermuda; and *C. verrilli* (Rathbun, 1901), considered endemic to Bermuda (Verrill 1908, Provenzano 1960, Markhan 1977, Chace et al. 1986). Two other taxa also described from the western Atlantic, *Calcinus sulcatus* (H. Milne Edwards, 1836) and *C. formosus* Neumann, 1878, are considered

junior synonyms of *C. tibicen* (see Provenzano 1959; McLaughlin, pers. comm.).

In 1985, during an expedition to the Gulf of Urabá, on the Caribbean coast of Colombia (Campos & Manjarrés 1988), the senior author collected a male hermit crab believed to represent an undescribed species of *Calcinus*. The coloration of the Gulf of Urabá specimen was most similar to that of *C. tibicen*, but morphologically the specimen was closest to *C. verrilli*. Because comparative material was not easily available to the senior author, the specimen was sent to the junior author who compared it with material of *C. verrilli* deposited in various museums and institutions in the United States. He too concluded that the specimen represented an undescribed species, the third in the genus *Calcinus* from the western Atlantic. Given that only one specimen exist-

ed, the preparation of a manuscript was delayed awaiting the possibility of collecting additional material. However, various collecting efforts since 1985 failed to produce any additional material, and we now describe this new species based on the male from the Gulf of Urabá.

As pointed out by Haig & McLaughlin (1984), species of *Calcinus* are morphologically very similar, and difficult to identify, particularly if color patterns have faded away. For this reason, it is appropriate to present along with the description of the new species, a comparison of the now three western Atlantic species of *Calcinus*. For this purpose, representative material of *C. tibicen* and *C. verrilli* were also examined. Illustrations of selected structures with diagnostic importance are included for all three species.

The material used remains deposited in the collections of the Indian River Coastal Zone Museum, Harbor Branch Oceanographic Foundation, Fort Pierce, Florida (IRCZM); Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (UMML), and the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM). The following abbreviations are used: SL, shield length (to the nearest 0.1 mm), measured from the tip of the rostrum to the midpoint of the posterior margin; juv: juvenile (s); ovig(s): ovigerous; RHG, Robert H. Gore; AJP, Anthony J. Provenzano, Jr.; WLS, Waldo L. Schmitt; sta, station.

*Calcinus urabaensis*, new species

Figs. 1a, 2a, 3a, 4a, 5a, b, 6a, 7a, d, g

*Calcinus* sp.—Campos & Manjarrés, 1988: 19.

*Material examined*.—Holotype: ♂ SL 5.6 mm, inlet of Pinorroa, Gulf of Urabá, Colombia, on rocks, ~3 m, USNM 251886.

*Description of holotype*.—Shield (Fig. 1a) slightly longer than wide, with scattered short setae; anterior margin weakly con-

cave; lateral projections obtusely triangular, with small terminal spine; anterolateral margins sloping. Rostrum produced, subtriangular, slightly in advance of lateral projections. Anterodorsal plate of branchiostegite (Fig. 2a) with acute anteroventral angle.

Ocular peduncles (Fig. 1a) long, slender (about 8.6 times as long as wide), and subequal to shield length; peduncles naked except for few short setae proximally on dorsal face, slightly curved outward (viewed laterally). Acicles terminating in strong spine; separated basally by  $\frac{1}{2}$  basal width of 1 acicle.

Antennular peduncles (Fig. 2a) reaching almost to base of corneae, naked except for tuft of setae proximally on penultimate segment. Ultimate segment 1.3 times as long as penultimate. Basal segment with mesial face unarmed; lateral face with distal margin armed with 4 (left) or 3 (right) small spines and 1 small submarginal spine.

Antennal peduncles (Fig. 1a, 2a) reaching to about distal  $\frac{2}{3}$  of ocular peduncles, segments with scattered setae. Supernumerary segment present. Fifth segment slightly curved outward. Fourth segment with dorsodistal spine. Third segment with strong ventrodorsal spine. Second segment with dorsolateral distal angle produced, terminating in strong bifid spine, lateral margin unarmed; dorsomesial distal angle with strong spine. First segment with 4 small spines on ventrodorsal margin, lateral face unarmed. Acicles slightly exceeding distal margin of fourth antennal segment, terminating in strong spine, dorsomesial margin with 2 (left) or 3 (right) spines, and 2 spines on dorsolateral margin. Flagellum almost reaching to distal end of extended left cheliped, minutely setose.

Third maxilliped with crista dentata formed of row of 25 small corneous teeth.

Left cheliped (Fig. 3a) with outer face of merus, carpus, and chela lacking setae. Fingers not leaving gap when closed, with spoon-shaped tips; cutting edges with irregularly-sized calcareous teeth and tufts of se-

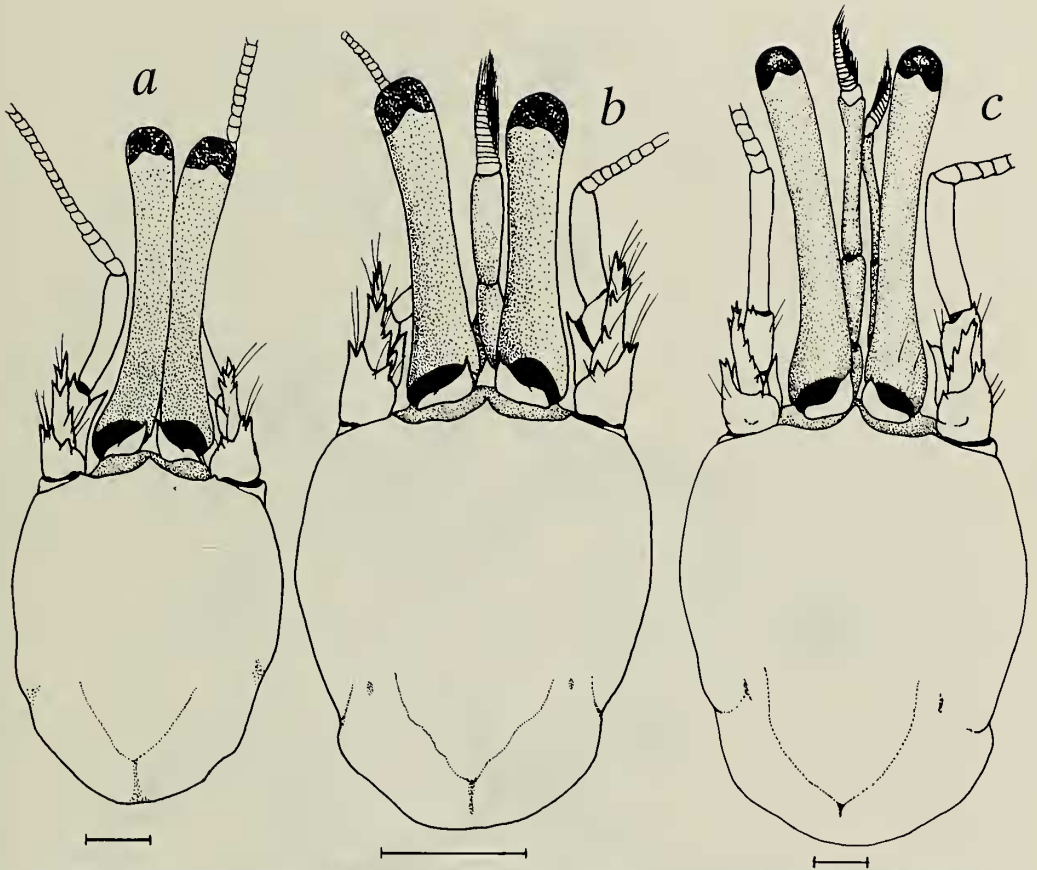


Fig. 1. Shield and cephalic appendages. a, *Calcinus urabaensis*, new species (antennular peduncles hidden under eyestalks); b, *Calcinus verrilli* (Rathbun, 1901); c, *Calcinus tibicen* (Herbst, 1791). Scales equal 1 mm.

tae. Dactyl with row of small spines on upper margin; outer face with irregular rows of low, closely-set tubercles. Fixed finger with row of corneous-tipped spines on lower margin; lower outer face with low tubercles similar to those on dactyl but smaller (spines and tubercles continued on lower outer face of palm). Palm 1.7 times as long as wide; upper margin with row of small, low protuberances; outer and inner faces smooth except for scattered tufts of short setae on inner face. Carpus with upper margin armed with 3 small spines on distal half and strong distal spine; outer distal margin with row of small tubercles on upper  $\frac{1}{3}$ ; outer face with prominent tubercle proximally on upper half; inner face smooth. Merus subtrian-

gular in cross-section, upper margin with scattered short setae; inner and outer lower margins with row of 2 or 3 small spines distally; outer and inner faces smooth.

Right cheliped (Fig. 4a) slightly overreaching proximal margin of dactyl of left cheliped. Fingers with spoon-shaped tips, with scattered tufts of setae, and leaving no gap when closed; cutting edges each with 3 strong calcareous teeth. Dactyl with row of corneous-tipped spines directed anteriorly on upper margin. Fixed finger with 4 small spines on outer face proximally. Palm with upper margin raised in form of crest, and armed with 5 strong, corneous-tipped spines; outer face with scattered setae, and 2 short oblique rows of corneous-tipped spines dis-

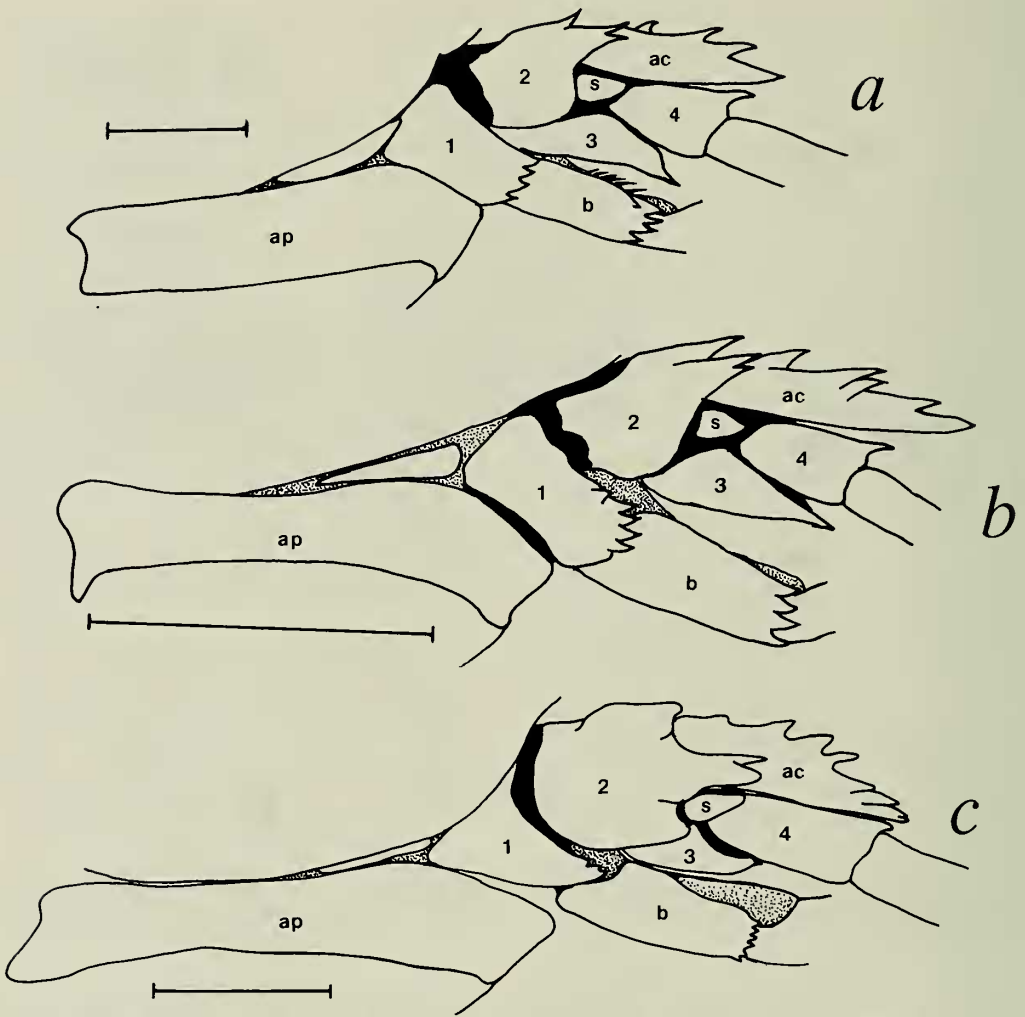


Fig. 2. Right antennular and antennal peduncle, and anterodorsal portion of branchiostegite, lateral view. a, *Calcinus urabaensis*, new species; b, *Calcinus verrilli* (Rathbun, 1901); c, *Calcinus tibicen* (Herbst, 1791). Scales equal 1 mm. (1-4: antennal segments; ac: antennal acicle; ap: anterodorsal plate of branchiostegite; b: basal antennular segment; s: supernumerary segment.)

tally; inner face smooth. Carpus armed on upper margin with 4 corneous-tipped spines, increasing in size distally; outer face with scattered minute tubercles; inner face smooth. Merus subtriangular, upper margin sparsely setose; inner lower margin with 6 spines; outer and mesial faces smooth.

Ambulatory legs slightly asymmetrical, left shorter and with propodi broader (viewed laterally) than right. Second pereopod (Fig. 5a) exceeding extended left che-

liped by about  $\frac{1}{2}$  length of dactyl. Dactyl subequal in length to propodus, terminating in sharp corneous claw, and with tufts of simple setae on mesial, dorsal, and lateral faces; ventral margin armed with 7 short corneous spines. Propodus with dorsodistal, corneous-tipped spine, and ventrodistal spine; outer and ventral faces with tufts of simple setae. Carpus with strong dorsodistal, corneous-tipped spine; ventral margin with small spine at about midlength of mar-



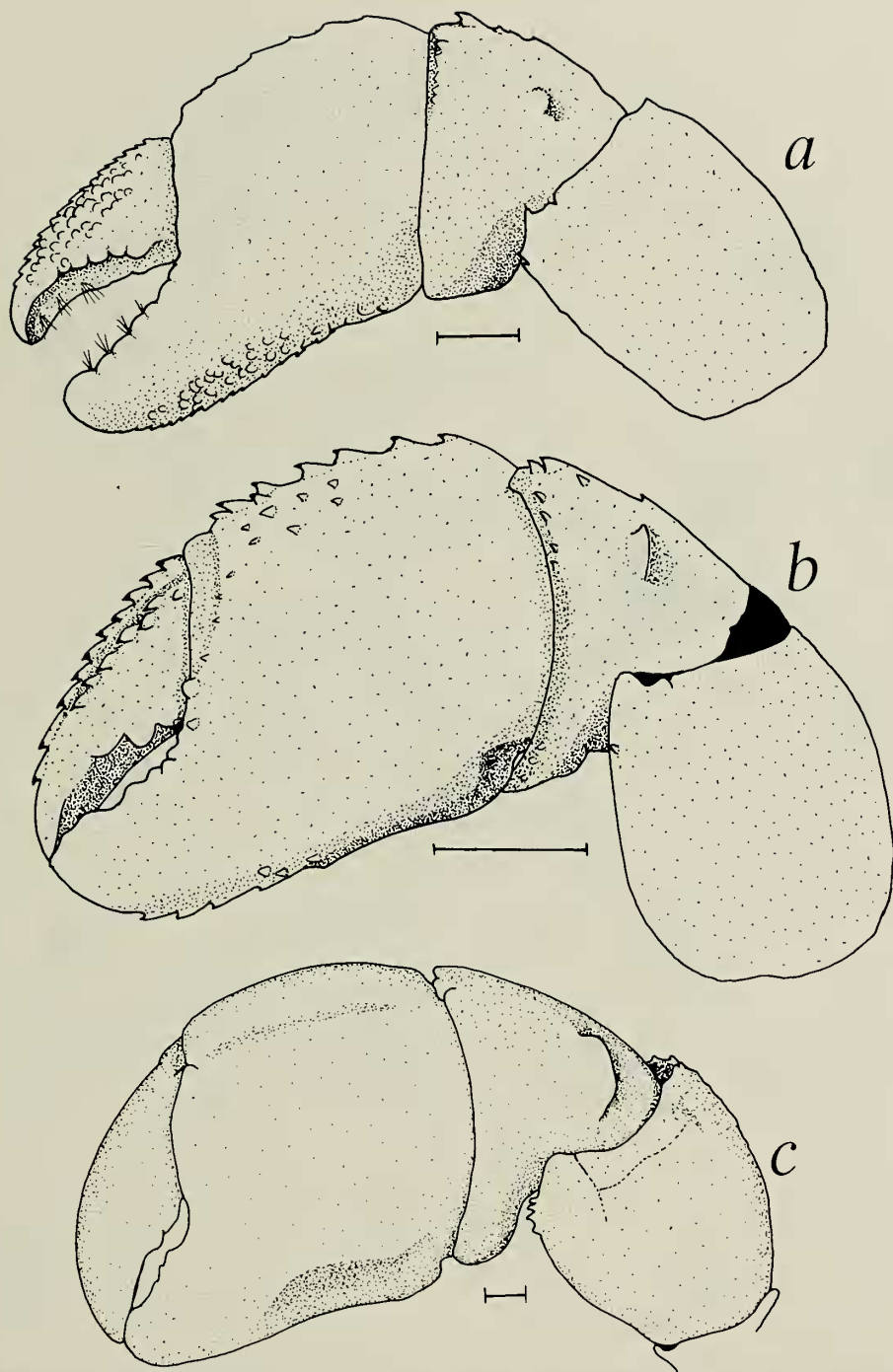


Fig. 3. Left cheliped, lateral view. a, *Calcinus urabaensis*, new species; b, *Calcinus verrilli* (Rathbun, 1901); c, *Calcinus tibicen* (Herbst, 1791). Scales equal 1 mm.

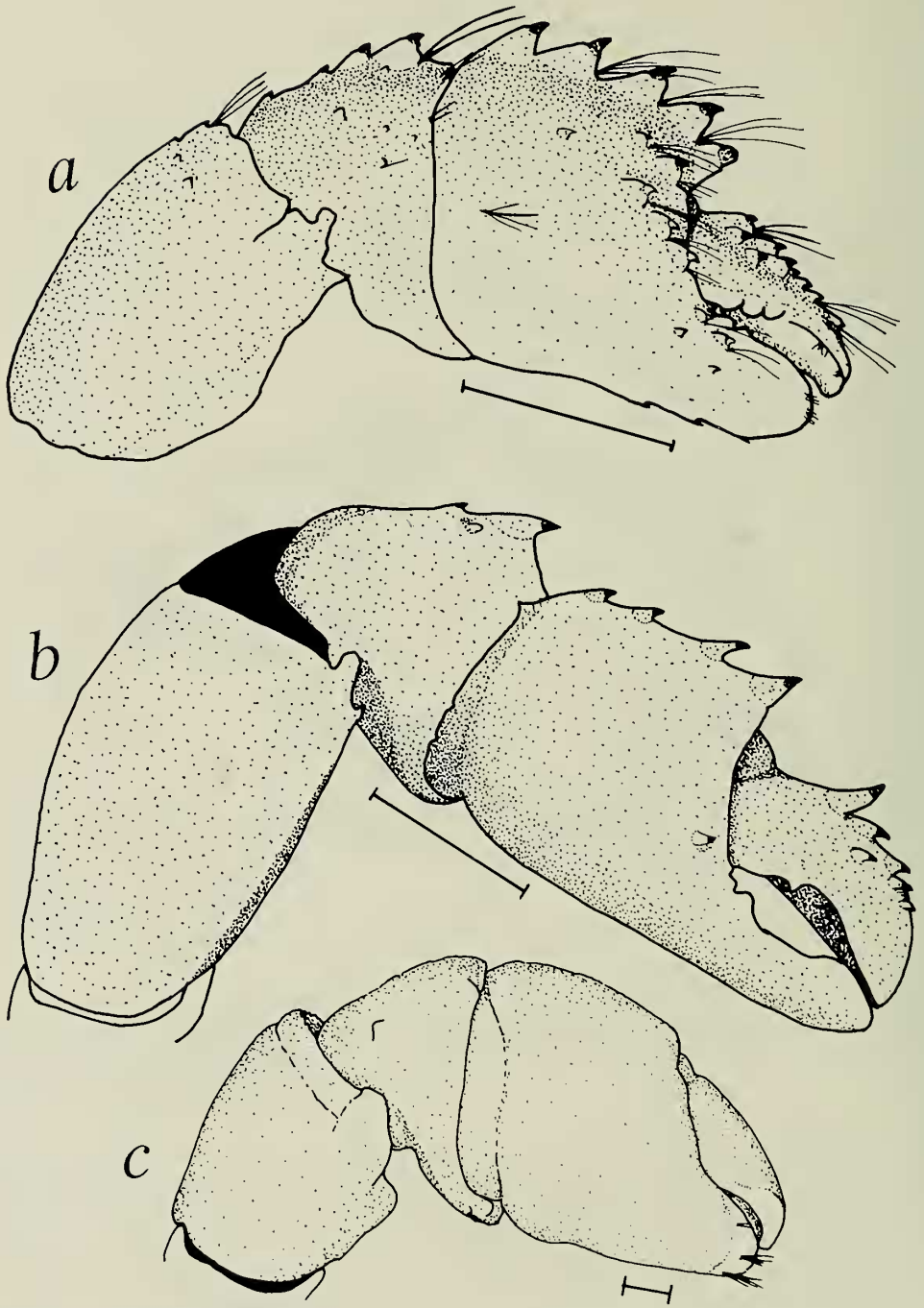


Fig. 4. Right cheliped, lateral view. a, *Calcinus urabaensis*, new species; b, *Calcinus verrilli* (Rathbun, 1901); c, *Calcinus tibicen* (Herbst, 1791). Scales equal 1 mm.

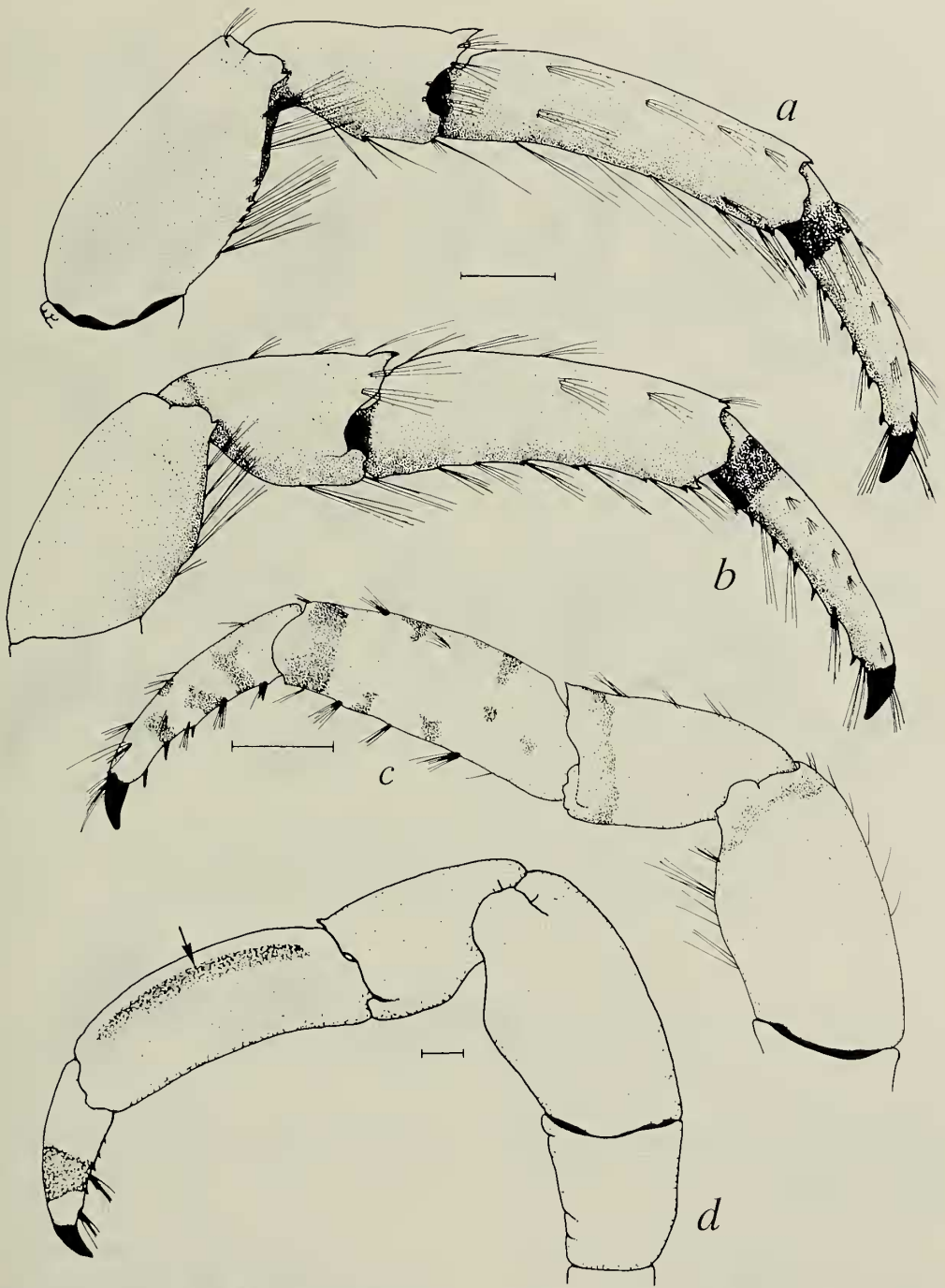


Fig. 5. Ambulatory legs, lateral view. a, b, *Calcinus urabaensis*, new species: a, right second pereopod; b, right third pereopod. *Calcinus verrilli* (Rathbun, 1901): c, left third pereopod. *Calcinus tibicen* (Herbst, 1791): d, left third pereopod. Scales equal 1 mm. (Heavily stippled areas represent color pattern, except for furrow indicated by arrow.)

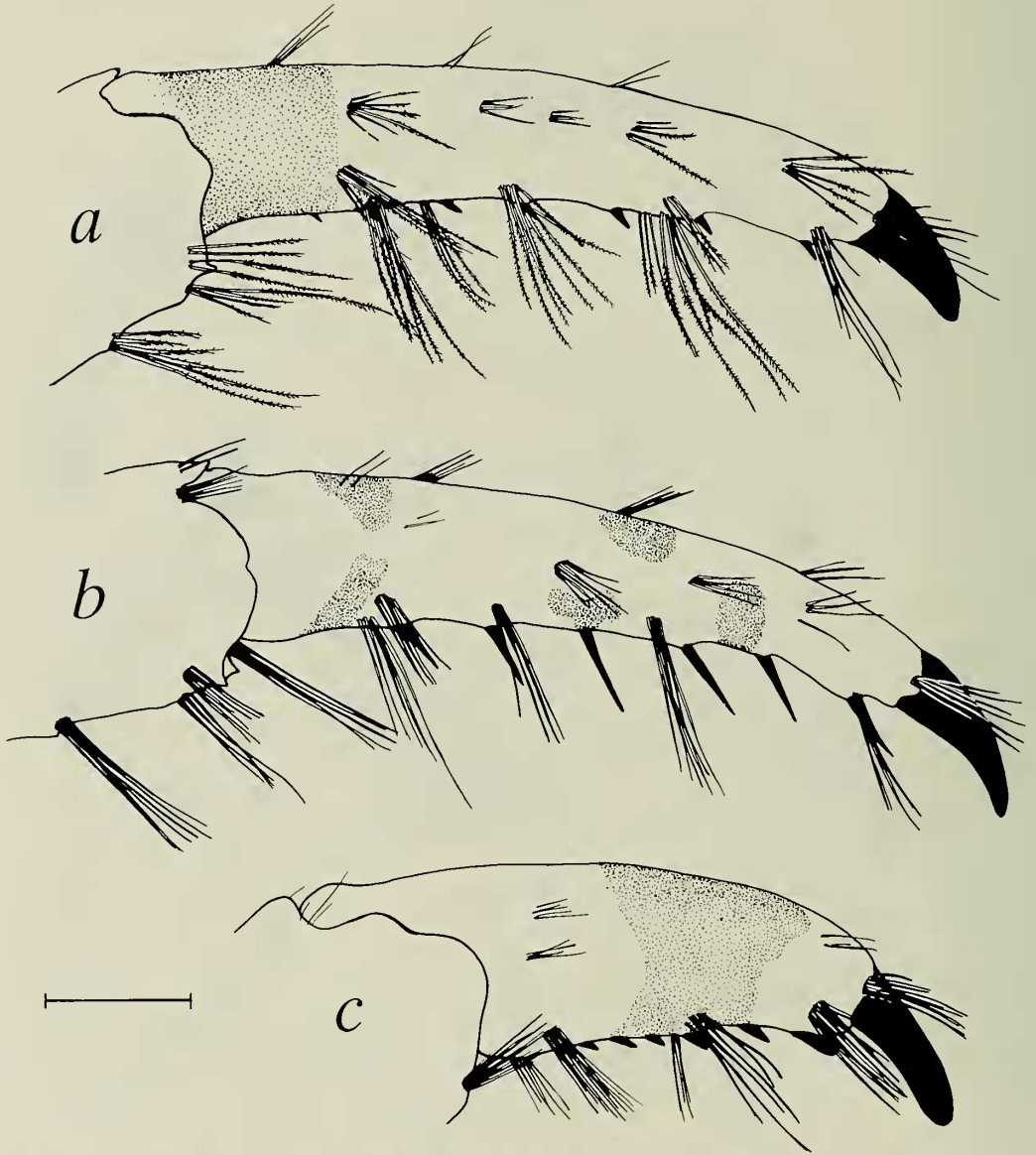


Fig. 6. Dactyl of right third pereopod, lateral view. a, *Calcinus urabaensis*, new species; b, *Calcinus verrilli* (Rathbun, 1901); c, *Calcinus tibicen* (Herbst, 1791). Scale equals 1 mm (a, c), 0.5 mm (b). (Stippled areas represent color pattern.)

gin, and long setae. Merus with spine distally on ventrolateral margin; ventral margin with row of small spines, and several tufts of long simple setae.

Third pereopod (Fig. 5b, 6a) slightly shorter, and with segments broader (viewed laterally) than second pereopod. Dactyl subequal in length to propodus. Dactyl and

propodus with tufts of long plumose setae on ventral margin. Propodus with dorso-distal, corneous-tipped spine, and ventro-distal spine; outer face lacking longitudinal furrow; outer and ventral faces with tufts of simple setae; ventral margin with row of small corneous spines. Carpus with strong dorsodistal, corneous-tipped spine; ventral



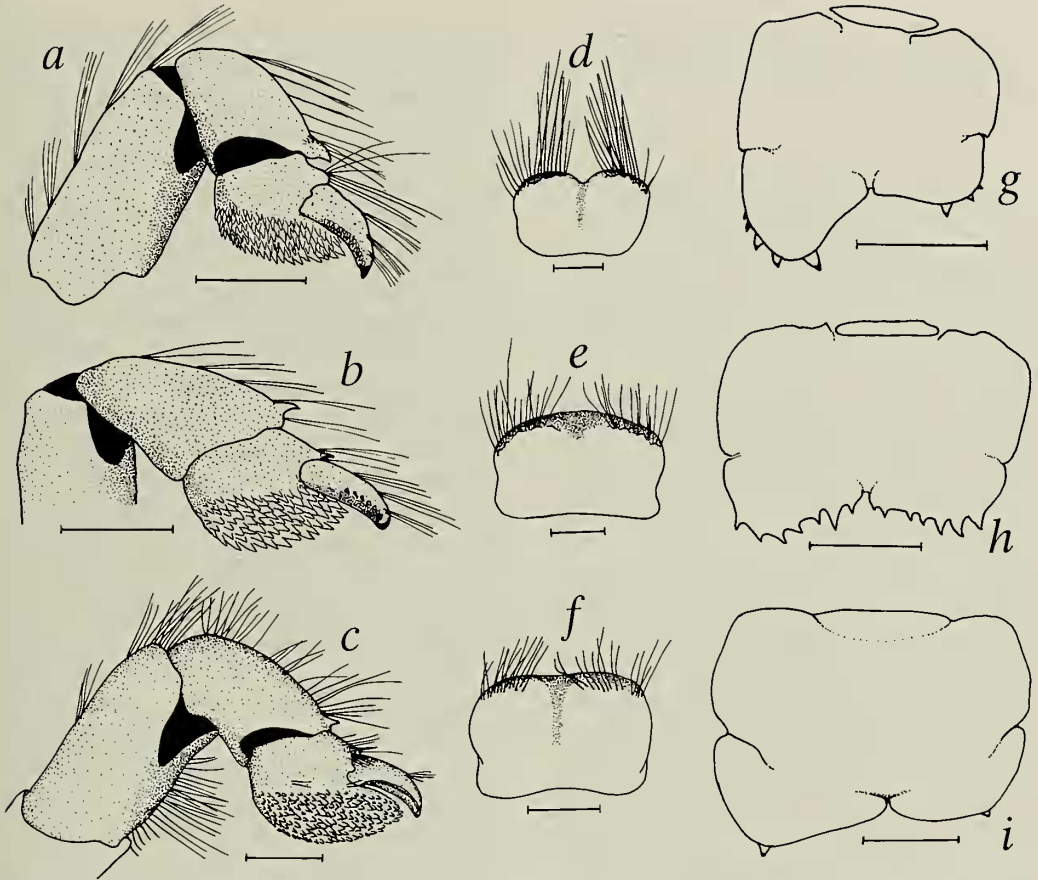


Fig. 7. Right fourth pereopod (a–c), lateral view, anterior lobe of sternite of third pereopod (d–f), ventral view, and denuded telson (g–i), dorsal view. a, d, g, *Calcinus urabaensis*, new species; b, e, h, *Calcinus verrilli* (Rathbun, 1901); c, f, i, *Calcinus tibicen* (Herbst, 1791). Scales equal 1 mm (a, c, i, g), 0.5 mm (b, d, f, h), and 0.25 mm (e).

margin unarmed, with long setae. Merus with spine distally on ventrolateral margin; ventral margin unarmed, with row of tufts of long simple setae.

Fourth pereopod subchelate (Fig. 7a). Dactyl with 13 small corneous spines ventrolaterally. Propodus unarmed dorsally. Carpus with strong dorsodistal spine.

Fifth pereopod chelate.

Sternite of third pereopods (Fig. 7d) with anterior lobe broad, subrectangular, developed as pair of subequal, rounded, setose projections divided by cleft, each projection with row of small tubercles distally.

Telson (Fig. 7g) with posterior lobes asymmetrical, left larger than right; sepa-

rated by narrow, distinct median cleft; terminal margins with 5 (left) or 3 (right) corneous-tipped, subterminal spines, and fringe of long bristles (not illustrated in Fig. 7g).

*Coloration in life (based on field notes).*—Carapace red with tinge of purple. Ocular peduncles purple basally, fading distally, and with cream-colored band near base of cornea. Chelipeds purple, fingers white. Ambulatory legs orange; dactyl cream-colored, except for dark red band proximally (Figs. 5a, b, 6a).

*Etymology.*—The specific name is given for the Gulf of Urabá, where the only specimen of this species was collected.

*Distribution and habitat.*—Known only

from the inlet of Pinorroa, Gulf of Urabá, Colombia; on rocks exposed to strong waves, in about 3 m of depth.

*Calcinus verrilli* (Rathbun, 1901)

Figs. 1b, 2b, 3b, 4b, 5c, 6b, 7b, e, f

*Clibanarius verrilli* Rathbun, 1901:238.—Alcock, 1905:161.—Verrill, 1908:449, pl. 27, fig. 5, pl. 28, fig. 6.—Gordan, 1956:310.

*Calcinus verrilli*.—Provenzano, 1960:120, fig. 1.—Hazlett & Provenzano, 1965:617.—Markham, 1977:131, pl. 1.—Chace et al., 1986:336, fig. 111, color pl. 10.2.—Morgan, 1991:910.

*Type material*.—Holotype ♂ (SL 7.8 mm), paratype ♀ (SL 4.2 mm), Bermuda, coll. F. V. Hamlin, USNM 24818.

*Additional material*.—Bermuda: 2 ♀ (SL 2.3–2.6 mm), coll. G. Brown Goode, 1876–1877, USNM 109433.—4 ♂ (SL 1.77–3.5 mm), Three Hill Shoal, 14 Nov 1958, coll. AJP, USNM 103734.—6 ♂ (SL 3.2–5.2 mm), 2 ♀ (SL 3.2–4.1 mm), 3 ♀ ovigs (SL 3.1–4.2 mm), ~3 km north of North Rock Reef, on coral reef, 42 m, 5 Sep 1979, coll. G. Wener, USNM 265218.—2 ♀ (SL 4.4–4.8 mm), 1 ♂ (SL 4.3 mm), North Rocks Reef, 14 Nov 1958, coll. AJP, UMML 32:1643.—1 ♀ (SL 2.8 mm), 1 ♂ (SL 3.0 mm), 1 juv (SL 1.9 mm), Western Ledge Reef, 13 Nov 1958, coll. AJP, UMML 32:1644.—5 ♀ (SL 4.3–4.7 mm), 3 ♂ (SL 4.4–5.2 mm), North Rocks Reef, 14 Nov 1958, coll. AJP, UMML 32:1645.—1 ♂ (SL 2.5 mm), Pt. at Shelly Bay, 8 Nov 1958, coll. AJP, UMML 32:1955.—1 ♀ (SL 5.2 mm), 15 ♂ (SL 3.6–4.3 mm), North Rocks Reef, 14 Nov 1958, coll. AJP, UMML 32:2216.—3 ♀ (SL 1.7–2.3 mm), 3 ♂ (SL 1.9–2.0 mm), N.E. Breakers, Sep 1966, coll. Schöne, UMML 32:5172.

*Diagnosis*.—Ocular peduncles (Fig. 1b) varying in relative length with specimen size, from moderately stout, about  $\frac{4}{5}$  length of shield in smaller specimens (SL  $\leq$  4.0 mm), to slender and subequal to length of shield

in larger specimens; acicles terminating in strong spine. Anterodorsal plate of branchiostegite (Fig. 2b) with blunt anteroventral angle. Left cheliped (Fig. 3b) with dactyl having upper margin and outer upper face with row of corneous-tipped spines; upper margin of palm with row of strong corneous-tipped spines, and outer upper face with several small spines on distal half; outer face of carpus with prominent tubercle on upper half. Fingers of right cheliped (Fig. 4b) leaving wide gap when closed; dactyl with strong, usually upwardly curved corneous-tipped spine proximally, and distal row of anteriorly directed spines; palm with row of corneous-tipped spines on upper margin; carpus with 2 or 3 corneous-tipped spines on dorsal margin. Ambulatory legs (Figs. 5c, 6b) with dactyl subequal in length to propodus and 5 to 7 long, slender corneous spines on ventral margin of dactyl; ventral margin of dactyl and propodus with several tufts of long simple setae. Third pereopod lacking longitudinal furrow on outer face of propodus. Fourth pereopod (Fig. 7b) with small dorsodistal spine on propodus. Anterior lobe of sternite of third pereopods (Fig. 6e) subrectangular, setose, often developed as pair of low, rounded projections, with or without small tubercles distally. Telson (Fig. 7h) with posterior lobes subequal, each with 7 spines on terminal margin, outermost spines on left lobe curved ventrally; terminal margin with fringe of long setae (not illustrated in Fig. 7h).

*Coloration in life* (after Provenzano 1960:120, and Chace et al. 1986: color pl. 10.2).—General color of body purple with red spots; eyestalks purple near base but with increasing red distally; area proximal to cornea white, cornea black or black spotted with white; chelipeds purple with red patches on upper distal face of carpus and merus; an irregular row of red pigment along upper margin of hand extends to dactyl; ambulatory legs with similar rows of red pigment on faces of segments (see Figs. 5c, 6b).

*Distribution and habitat*.—Endemic to

Bermuda; subtidal to 110 m, in attached vermetid gastropod shells of *Spiroglyphus irregularis* and *S. annulatus*, or unattached gastropod shells (Markham 1977).

*Remarks.*—Some specimens of this species (UMML material) exhibit sexual dimorphism in the armature of the chelipeds. The outer face of the right palm in some females is armed on the distal half with three or four small spines, whereas in some males the outer face is armed with only one distal spine. Males tend to have more spines on the right cheliped than females. The number and strength of the spines of the upper margin of the left palm and dactyl varies according to sex of the individual, being fewer and stronger in large males (SL > 4 mm) than in females of similar size.

Three male specimens were found to have both male and female gonopores. One male (SL 5.2 mm, UMML 32:1645) had female gonopores on the right and left side, and two males (SL 5.1 mm, 5.6 mm, UMML 32:2216) had only one female gonopore on either the left or right side. McLaughlin & Lemaitre (1993) have reported specimens with both male and female gonopores in the tube-dwelling hermit crab *Paguritta kroppi* McLaughlin & Lemaitre. As in *P. kroppi*, it is unclear whether the condition observed in the specimens of *C. verrilli* represents an aberration or a reproductive adaptation, such as protandry or protogyny, to a restricted mode of life.

*Calcinus tibicen* (Herbst, 1791)

Figs. 1c, 2c, 3c, 4c, 5d, 6c, 7c, f, i

*Cancer tibicen* Herbst, 1791:25, pl. 23, fig. 7.

*Pagurus sulcatus* H. Milne Edwards, 1836: 279.

*Calcinus formosus* Neumann, 1878:31.—Alcock, 1905:164.—Gordan, 1956:304.—Morgan, 1991:907.

*Calcinus sulcatus*.—Benedict, 1901:141, pl. 5, figs. 3, 3a.—Alcock, 1905:164.

*Calcinus tibicen*.—Provenzano, 1959:363, fig. 4.—Forest & De Saint Laurent, 1967:

106.—Sánchez & Campos, 1978:22, fig. 5.—Chace et al., 1986:335, fig. 111.

*Material examined.*—Florida: 1 ♀ (SL 5.3 mm), Fort Pierce, Dynamite Point North, beach in rocky tide pool, 18 Mar 1972, coll. R. G. Gilmore, IRCZM 89:050.—1 ♂ (SL 4.2 mm), 1 ♀ (SL 3.3 mm), 1 ♀ ovig (SL 4.4 mm), Vero Beach, 100 yards (91 m) off Sand Point, 10 ft (3 m), on coquina shelf, 28 Jun 1972, coll. RHG, IRCZM 89:219.—1 ♂ (SL 6.3 mm), St. Lucie County, Walton Rocks, in worm reef during night survey, intertidal, 27 Jan 1975, coll. RHG, IRCZM 89:2625.—1 ♂ (SL 4.6 mm), Stuart, north of St. Lucie Inlet, in worm reef by “Fish Bowl” channel, intertidal, 12 Apr 1972, coll. RHG, IRCZM 89:101.—1 ♀ ovig (SL 5.2 mm), St. Lucie County, Walton Rocks, Hutchinson Island, across from Florida Power and Light Company plant, intertidal, 9 Jul 1975, coll. J. Dudley, IRCZM 89:2302.—1 ♂ (SL 6.7 mm), Indian River, Martin County, near St. Lucie Inlet, on rocks, 4 May 1988, coll. R. S. Rox, IRCZM 89:06472.—1 ♀ (SL 3.3 mm), Tortugas, 21 Jun 1932, coll. WLS, USNM 102696.—1 ♂ (SL 4.5 mm), Tortugas, 19 Jul 1930, coll. WLS, USNM 102697.—2 ♂ (SL 3.0–6.0 mm), 1 ♀ (SL 4.9 mm), Tortugas, sta 34–32, 5 Jul 1932, coll. WLS, USNM 102698.

Virgin Islands: 1 ♂ (SL 3.3 mm), St. Croix, Christiansted, East Little Princess, intertidal under rocks, 17 Aug 1971, coll. W. E. Rainey, USNM 154541.

Jamaica: 1 ♂ (SL 4.3 mm), Port Antonio, coral reef off Navy Island, 1932, USNM 77398.

Barbados: 2 ♂ (SL 5.8–6.3 mm), 1 ♀ (SL 4.9 mm), Hasting’s Reef, opposite St. Matthias Church, 20 Jul 1959, coll. A. G. Humes & R. U. Gooding, USNM 104256.

Antigua: 13 ♂ (SL 3.3–8.7 mm), 4 ♀ (SL 2.2–3.5 mm), 10 ♀ ovigs (SL 3.3–5.3 mm), Smithsonian-Bredin Caribbean Expedition 1956, sta 73–56, Charlotte Point (=Nutting’s “Rocky Point”), English Harbor, 2 Apr 1956, USNM 265157.



Belize: 1 ♂ (SL 4.8 mm), 1 ♀ ovig (SL 5.5 mm), 15 Jul 1930, coll. P. W. Shufeldt, USNM 102700.—1 ♂ (SL 6.4 mm), Carrie Bow Cay, lagoon, 2–3 m, 25 Apr 1975, USNM 184516.

Isla Providencia (Colombia): 1 ♂ (SL 6.3 mm), Bahía Maracaibo, sandy-rocky beach, 28 Mar 1991, coll. G. E. Ramos, USNM 259399.

Panamá: 2 ♂ (SL 3.3–6.7 mm), Colón, Coral reef, 2 May 1911, coll. Meek & Hildebrand, USNM 44191.

Curaçao: 1 ♂ (SL 4.0 mm), 1 ♀ (SL 4.8 mm), Caracas Bay, 1920, coll. C. J. van der Horst, USNM 57513.

*Diagnosis.*—Ocular peduncles (Fig. 1c) slightly shorter than length of shield; acicles terminating in strong spine (occasionally bifid or trifid) distally. Anterodorsal plate of branchiostegite (Fig. 2c) with blunt anteroventral angle. Antennular peduncle (Fig. 2c) with lateral face of basal segment armed with 4 to 6 small spines on distal margin. Chelipeds lacking setae, surfaces minutely granulose. Left cheliped (Fig. 3c) with chela unarmed; outer face of carpus with prominent subrectangular lobe proximally on upper half. Right cheliped (Fig. 4c) unarmed except for small tubercle proximally on outer face of carpus; fingers not leaving gap when closed. Ambulatory legs (Figs. 5d, 6c) each with dactyl shorter than propodus (about 0.6 times length of propodi); ventral margin of dactyl with row of 4 to 7 short corneous spines, and several tufts of short simple setae; lateral face of propodus of third pereopods each with distinct longitudinal furrow on upper half of lateral face. Fourth pereopod (Fig. 7c) with dorsal margin of propodus unarmed. Anterior lobe of sternite of third pereopods (Fig. 7f) subrectangular, setose, often developed as pair of low, rounded, unarmed projections. Telson (Fig. 7i) with posterior lobes asymmetrical, each usually with 1 submarginal spine; terminal margin with fringe of long setae (not illustrated in Fig. 7i).

*Coloration in life* (after Provenzano 1959:

363, and Chace et al. 1986:335).—Chelipeds red-brown to maroon, often tinged with purple, and with white fingertips. Dactyls of the ambulatory legs white or yellow, with a red band (Figs. 5d, 6c). Eystalks orange-red fading to white near cornea. Carapace usually red, often tinged with purple (rarely green), and with white punctae.

*Distribution and habitat.*—Florida, Gulf of Mexico, Caribbean to Brazil, including Bermuda; lower intertidal and subtidal to 18 fms (32.9 m); commonly encountered, in hard substrates such as rocky bottoms, worm reef platforms, and coral reefs.

*Remarks.*—Several carcinologists have indicated that *Calcinus tibicen* is broadly distributed in the West Indian region from Florida to Brazil, including Bermuda [e.g., Alcock 1905 (as *C. sulcatus*), Verrill 1908 (as *C. sulcatus*) Schmitt 1935, Provenzano 1959, Abele & Kim 1986, Morgan 1991].

#### Morphological Comparison of *Calcinus* Species from the Western Atlantic

*Calcinus urabaensis* is similar to *C. verrilli* but differs from it in a number of attributes, and specially coloration. In the absence of coloration, the most reliable difference between *Calcinus urabaensis* and *C. verrilli* can be found on the chelipeds, the dactyls of the third pereopods, and the telson. The dactyl of the left cheliped in *C. urabaensis* has a row of small spines on the upper margin, and irregular rows of low, closely-set tubercles on the outer face; the dactyl in *C. verrilli* has two rows of corneous-tipped spines, one row on the upper margin and another on the upper outer face. The left palm in *C. urabaensis* is armed on the upper margin with small, low protuberances, whereas this margin is armed with a row of strong, corneous-tipped spines in *C. verrilli*. On the right cheliped of *C. urabaensis* the dactyl is armed with a row of spines directed anteriorly, whereas in *C. verrilli* the dactyl has a strong, upwardly



curved spine proximally, followed distally by smaller anteriorly directed spines. The upper margin of the right palm in *C. urabaensis* is crest-like and armed with a row of five strong spines; the upper margin of the palm in *C. verrilli* also has spines but is not raised in the form of a crest.

*Calcinus urabaensis* is unique among the western Atlantic species of *Calcinus* in that dactyls of the third pereopod have several tufts of long plumose setae on the ventral margin. A similar condition is found in other *Calcinus* species, all distributed in the Indo-Pacific region: *C. vachoni* Forest, *C. sirius* Morgan, *C. spicatus* Forest, and *C. latens* (Randall) (see Morgan 1991).

The telson in *C. urabaensis* has the posterior lobes distinctly asymmetrical, left the largest, and the terminal margins of the lobes are armed with 3–5 subterminal spines. In contrast, the telson in *C. verrilli* has the posterior lobes weakly asymmetrical, and the terminal margins of the lobes are armed with 7 terminal spines.

*Calcinus tibicen* can immediately be separated from the other two western Atlantic species of the genus by the smooth, unarmed chelipeds, the longitudinal furrow on the lateral face of the propodus of the third left pereopod, the stout dactyls of the ambulatory legs, and the distinctive color pattern that often persists for many years in alcohol-preserved specimens. Although the coloration of *C. tibicen* generally resembles that of *C. urabaensis*, the two species otherwise differ markedly. The two can readily be differentiated by the armature of the chelipeds (armed with spines in *C. urabaensis*, unarmed in *C. tibicen*), and the setation of the dactyl of the third pereopod (plumose in *C. urabaensis*, simple in *C. tibicen*).

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